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U. S. Department of Health, Education, and Welfare

Public Health Service

THE

SUBSTANCE OF A REPORT,

READ BEFORE THE

Georgia Medical Society,

BY A

COMMITTEE OF ITS MEMBERS,

FEBRUARY 4, 1809;

IN OBEDIENCE TO THE FOLLOWING RESOLUTION:

"That a committee of three persons be appointed to report, at the next regular meeting of the society, on the injurious consequences, which result to the inhabitants of Savannah, from the cultivation of the contiguous low grounds in rice; and what would be the probable effects that would arise, from a change in the mode of their cultivation."

Published at the request of the Citizens of Savannah.

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1809.

Substance of a Report, &c.

MR. PRESIDENT,

IN the progress of the inquiry, so important to the health and well-being of the inhabitants of this city, which you have assigned to us to institute, as your committee, we have consulted, not merely our own reason and experience, but have applied liberally to all the sources of information of the most eminent authors, treating on similar subjects, to which we could procure access; and we present you this report, as but little else than a summary of what they have said, and written.

In the very threshold of this inquiry, we meet with the received opinion, that the healthiness of a country is generally in proportion to its distance from the equator. It has been remarked, and, we think, not without many claims to the truth, "that every thing in nature must yield to climate." Though it cannot, indeed, essentially alter and re-constitute the generic character of matter, either animate or inanimate, yet, climate cer-

tainly possesses the power of changing and modifying the figure, the shape, and the apparent qualities of things, whether they appertain to the terrene and aquatic portions of this globe; to the atmosphere, that envelopes them; or to the animals, vegetables, and minerals, which inhabit them—man himself not excepted. But, when climate is admitted to possess a power so modifying and impressive as this, it becomes necessary to be particular in our definition of it.

"Climate has been commonly understood to mean nothing more," says Mr. Volney, "than the degree of latitude; but as the heats and colds of a country have some connection with the degree of its latitude, common opinion has rendered the terms *climate* and the *temperature* of a country nearly synonimous: yet it is not strictly true, that the temperature of a country is necessarily regulated by the latitude. On the contrary, it seems to be modified by, and sometimes wholly to depend upon, various circumstances of surface and exposure. Thus, this temperature is materially affected by the scarcity or prevalence of trees, or of water; by the height of its general level above the sea; by the quarter to which its slopes are turned; and, above all, by the quality, force, and direction, of those ærial currents, denominated winds."

Hence it is, that climates, thus understood to to embrace, in this general acceptation, both the degrees of heat and salubrity of a country, derive their peculiar and specific character from the winds, and from the relative local circumstances

of a country, together with its elevation, more than from the latitude; and hence also, it is, that neighboring situations, whose physical and topographical circumstances are wholly dissimilar; the one suited to health and comfort—the other evolving, autumn after autumn, the lurking and noxious fluid of disease, are forced, by the law of the winds, to have a perpetual commerce of atmospheres and interchance of climates.

From this view of the subject, then, the formative and new-modelling influence of climate, which is admitted by all, is the joint product of the *temperature* of a country, and of the *kind of winds* that visit it; in other words, it is the natural offspring of the *sensible* and *insensible* qualities of the atmosphere, as influenced by the local situation of a place, and the *nature* of the winds that blow over it.

Savannah, standing in the latitude of 32, 10, north, comes within the description of climates of great heat; and, indeed, under the *present mode* of the cultivation of its adjacent country, and the present customs of its inhabitants, *unaccommodated* to its climate, adds another support to this general opinion of the insalubrity of such latitudes; yet "perhaps no climate or country is unhealthy," says Doctor Rush, "where men acquire, from experience or tradition, the arts of accommodating themselves to it. The history of all the nations in the world, whether savage, barbarous, or civilized, previously to a mixture of their manners, by an intercourse with strangers, seems to favor this opinion."

An investigation of the causes which have produced, and which continue to produce, the *present state* of its autumnal atmosphere, from which four-fifths of our diseases are derived; and an examination of the means within the reach of reason and art to prevent and destroy them, will form the two divisions of our report.

The city itself presents a combination of circumstances favorable to health; but we speak here of the city exclusively. Though situated in a warm latitude, this alone would not make it unhealthy; and its being so cannot be accounted for from its immediate topography. The elevation of the town, the sandy and absorbing nature of its soil, and the judicious manner upon which it is planned, are all so many circumstances in its favor. Few cities are better planned, either for beauty, comfort, or health. Some, perhaps, would complain of the narrowness of the streets, and the number of lanes, but it is questionable, whether these offer any just objection. Facts and experience prove that many cities, in latitudes equally warm, of which the streets are much narrower, enjoy a great portion of health. It would be out of place to detail here all the reasoning which a knowledge of these facts has elicited. We will sum them up in the observation, that lofty buildings, narrow streets, and small windows, produce their salubrious effects in warm climates, by obstructing the admission into the streets and houses of the solar heat; and thus diminish the temperature of such cities, which acts as chief among the *exciting* causes of their diseases.

The levelness of the ground, on which Savannah stands, might, by some, be urged as another objection; but this is amply atoned for in the qualities of its soil. Of silicious earth, for many feet beneath the surface, the streets of Savannah solicit the absorption of superfluous moisture, and the transmission of the peccant matters with which the offal of the city may have impregnated it, below the putrescent and evaporating agency of the sun. This is a fact of no small importance, and one on which we erect the conclusion, that the sources of our autumnal diseases are *without* the city.

It will be more clearly demonstrated hereafter, that certain definite circumstances are indispensable in the production and continuation of that process of nature, (putrefaction) by which, we suppose, the autumnal air is polluted. These are, a *certain* degree of moisture and of heat, and the presence of *dead* animal and vegetable substances. All cities furnish an abundance of the latter. These matters thrown into the streets and alleys, when detained upon the surface, if there be a due quantity of moisture, putrify under the agency of the autumnal sun, and contaminate the air. Thus, in cities in warm climates, with paved streets, is produced an internal source of disease. In this respect, Savannah enjoys an advantage over cities under similar circumstances, whose streets are paved. The putrescent matters, exposed in its streets, are rendered inoffensive by the quality of their soil. Here, every shower of rain displaces them, by dissolving them, and per-

colating with them through the upper stratum of earth, beyond the reach of the solar heat. Pavements, which add so much to the ornament and convenience of cities, would, with us, alter the case materially. The offal of cities, both animal and vegetable, are more or less viscid and glutinous. They adhere to the pavements, and lurk in their cavities and depressions, exposed to the influence of the sun. Rains and ordinary ablution are insufficient to remove them. They are, consequently, left exposed to all the circumstances that invite putrefaction, and the generation of impure air. In the present condition of our city, we are exempt from this internal source of disease, so common and prolific in other cities of the United States, in latitudes more favorable to health.

If, then, it be true, that neither the plan of Savannah, nor any thing within its limits, can, with any coloring of justice, be urged as the causes of its sickliness in the fall, they must be sought for elsewhere. That they do exist, admits of no doubt; for their effects are numerous and melancholy.

In making an application of the above remarks to the climate and topography of Savannah, and its adjoining places, it becomes necessary,

1st. To take a retrospect of their condition, before the hand of civilization began to alter it;

2d. To investigate the causes of the deterioration of their original healthiness, which follow-

ed, step by step, this alteration from their primitive state; and,

3d. To suggest the means, which, under the direction of reason and industry, will restore that degree of salubrity of climate, with which nature presented them to us.

Oglethorpe, and his colonial associates, were the first civilized settlers of Georgia. In 1733, he planted his colony upon the bluff, on which this city now stands. Like every other civilized pioneer, who had before him visited the American continent, he found the natives in the savage state, subsisting on the profits of fishing and hunting. Ignorant and indolent, the aboriginal Indian neglected and shunned the cares and labors of agriculture. The rearing of a small quantity of maize, or Indian corn, and a few other vegetables, comprised the whole of his agricultural attention. Nature spontaneously presented him with a hardy, but healthful subsistence. He valued more the game, than the vegetable wealth of the islands and swamps. He lived and roamed in the midst of them, exempt from those diseases that soon followed the settlements of the European. Oglethorpe found the tribes which inhabited this bluff and the country around it, in the possession and enjoyment of as much health, as those whose towns were scattered upon the hills. In short, he received the country from the hands of nature, pure and healthy.

The colonists, for years after their arrival, were chiefly engaged in the operations of security and protection, and in building and accumu-

lating convenience about them in town. They exercised the agriculture necessary for their support, at first, upon the open plain, the preparations for which being attended with the least difficulty. They, as yet, spared the swamps and low grounds. The abundant ramification and thick foliage of their vegetation, at this time, purified the atmosphere by a rule of the vegetable economy, moistened and cooled the fervor of the summer heats, and prevented the fermentative access of the solar ray to the pestilential evils, which slumbered in their bosom.

The memory of many yet living, and the records of the first settlements of the colony, attest and confirm the fact of its original salubrity. We find some account of it in the records at Ebenezer, and in those of this place. In a letter of Mr. Bolzius, a German clergyman, at Ebenezer, dated the 26th of June, 1740, he says, "That, in a whole year, *but one child* had died, and that about four years old." His congregation consisted of 146 persons. Children, of course, were not included in this number. In September and October of the same year, when the yellow fever raged in Charleston, colonel Stephens states, "that the fall of the leaf had produced a very sickly season in Savannah. Fluxes, dry gripes, and lingering fevers, had carried off, in two months, *seven or eight people*, which was more than had died in a *whole year* before." The following fact is a confirmation of the truth of these early records of the primitive healthiness of this country, viz. That Georgia, and Savannah in

particular, for many years after its settlement, furnished a secure retreat, during their sickly season, to the inhabitants of Charleston, and the neighboring ports of Carolina.

This salubrious condition of this country continued about twenty years from its first settlement by Europeans, with but slight variations; when the inhabitants, urged and stimulated by the money-making example of their neighbors in Carolina, began to fix their attention on the profits arising from the cultivation of the fat and boggy soil of the swamps and islands in rice. This kind of agriculture no sooner commenced, than it was succeeded by an unhappy change in the temperature and salubrity of the climate. The introduction of slaves about this period, (for a length of time wisely interdicted by the charter of the colony) much facilitated it. Hitherto, an epidemic was unknown in this (then) colony; and the following language of the first German settlers at Ebenezer proves, that the heat of this country was, at that time, much less intense, and much more sufferable, than it is at present. "Though greater" (the heat) say they, "than that of the country we have left, yet we labor with comfort and safety." What would now be the remark of their descendants? Their virtuous ancestors long repressed the avaricious cupidity of the settlement at Savannah, by remonstrating time after time against its petitions, imploring the privilege of participating in the infinitely demoralising vice of slavery. Their language against these petitions was, addressing them-

selves to that part of the colony settled at Savannah, " We are but men as well as you, and we are made up of no other materials. We find the climate neither too hot, nor too sickly, for us to labor." In this remonstrance they were seconded by the Scotch settlement at Frederica. As the natural consequence of the mode of agriculture that has obtained, their posterity might now say, in good earnest, " Broken down by the *heats* and *fevers* of the climate, we have scarce strength and spirits enough left to labor for our support!"

It will not be inapt, in this place, to listen to the language of doctor Franklin on this subject. In a letter to doctor Priestley, when they were corresponding on the effects of vegetation upon the atmosphere, he remarks, " the strong, thriving state of your mint, in putrid air, seems to shew, that the air is mended by taking something from it, and not by adding to it. I hope this will give some check to the rage of destroying trees that grow near houses, which has accompanied our late improvements in gardening and agriculture, from an opinion of their being unwholesome. I am certain, from long observation, that there is nothing unhealthy in the air of woods; for we, Americans, have every where our country habitations in the midst of woods, and no people on earth enjoy better health, or are more prolific." There are yet many parts of this country which demonstrate, that even swamps and low-grounds, when in the state of nature, are not only innocuous, but extremely salutary. The great " Dismal Swamp," as it is vulgarly called, which

is common to Virginia and North-Carolina, on their maritime border, presents to the inhabitants of Norfolk, and the neighboring low country, a *recess of health* in the sickly season. The vegetation of this swamp is so thick and abundant, in many parts of it, as to exclude light, (and, of course, prevent the putrescent effect of heat) to a degree that renders the torch frequently necessary to conduct them to their temporary habitations. In the state of Delaware, laborers pass whole summers and autumns, in making shingles in the cedar swamps, without being affected by fevers, or sickness of any kind. Persons who spend the warm months in the cedar and pine swamps in North-Carolina, are likewise equally free from disease. In our own neighborhood exists the result of an experiment, the product of accident, decisive of this question. In the bosom of a settlement at a short distance from White-Bluff, there is a swamp of ten acres: Twenty-five or thirty years ago, this swamp was cleared for the culture of rice. Before this, the settlement was accounted very healthy. The fact was now reversed. Each returning autumn committed to the breeze the diffusion of endemic pestilence, till the proprictor of the swamp, from the loss, by disease, of force sufficient to cultivate it, was reduced to the necessity of abandoning it. Within sixteen years the poplar and the ash, with a thick undergrowth, have reared themselves to repress its morbid exhalations. The neighborhood is again healthy. But this change from health to disease, and again from sickliness to sa-

lubrity, is not peculiar to the climate and topography of this country. Every state in the union—nay, every county in each state, have experienced the same changes, in a greater or less degree. We may, indeed, go beyond the limits of the United States, and find abundant accounts of the same changes and of similar effects, attendant upon the clearings and cultivation of the first agriculturists of the countries of Europe. The annals of Greeee, Italy, Hungary, the Netherlands, not to mention any more, present many fatal histories of this kind. In the sixteenth century, the banks of the Danube, of the Drave, and the low marshy grounds in their vicinity, gave birth to the famous Hungarian fever, which excited such terror in Europe, by marking its course with death for one or two centuries. Time, aided by the art and industry of its inhabitants, has destroyed the concourse of circumstances which produced that fever, and it is now only to be found in the history of that country. The physicians and historians of Italy enumerate twenty plagues within the space of five hundred years, from the building of the city. But the draining and cultivation of its soil, conducted by the suggestions of reason and experience, had sapped the vitals of these pestilential evils, till the invasion of the Goths, who demolished, with wicked and depredatory fury, the banks and canals, which the Romans had so sedulously constructed for convenience, as well as for health. The consequence was, the partial drying up of some places and the inundation of others. Plague and pestilence re-appeared, and

continued till industry again effected a desiccation of the soil. The Netherlands, now the seat of cleanliness and health, were formerly the theatre of the ravages of epidemics. It is, indeed, happy for mankind, that these pestilential evils, the result of the operations of ignorance and avarice in the first settlers of a new country, have been, and still may be, controled by time, by reason, and by human industry. All Europe, and many parts of the United States, evince it. But, heretofore, the beneficial change in the atmosphere of certain parts of this country, has been the product of time merely. As yet, science and art have effected but little in the southern states, in the great work of drying up the sources of disease, and cleansing the atmosphere. All parts of the United States were, at first, healthy. The clearings of the first agricultural settlers rendered them sickly. They remained so, the degree and duration varied by circumstances, till time, sometimes assisted by art, had completed the dissolution of the vegetable matters, thus exposed by death to decay and putrefaction. So uncommon were fevers of the mildest type, at one period of the settlements of Pennsylvania, that there is an instance upon record of people travelling twenty miles to see whether it was possible for a German girl, who labored under ague and fever, to be *hot* and *cold* at the same time. In many parts of the middle and southern states, we have known this sickly period not to exceed thirty years from their first settlement. The fluctuations in the condition of the atmosphere of a country, in its

passage from the *natural*, through the *cleared*, to the *cultivated* state, have been fully experienced by the inhabitants of the middle grounds of Georgia, the two Carolinas, Virginia, Maryland and Pennsylvania. Fifteen, twenty, and thirty years, according to circumstances, have been sufficient to restore to them nearly their primitive salubrity, while the influence of seventy years in this state, and more than a century in the others, has proved ineffectual in improving the healthiness of their maritime borders. The operation of time alone presents annually to the inhabitants of the former, an abridgement in the catalogue of their diseases; but to those of the latter, a table of nosology, each year augmented in bulk, and varied by accounts of new symptoms and more virulent cases. We need only look to the difference in the mode of cultivation of the two divisions of our country we have noticed, to be taught the reasons of this very opposite result.

We have already stated, that the developement of this truth, as it respects Savannah, cannot be obtained from an inspection and examination of its interior topography. Every local circumstance of the town implies a guarantee of health; as great, indeed, as is consistent with a climate so warm. With regard to its immediate topographical condition, we repeat, that, high, dry, and extremely bibulous, the soil of Savannah is as free from any agency in the production of the complaints of its inhabitants, as that of the hills on the middle ground, or of the mountains. Indeed, we may say more so; for it is mostly

owing to this quality of its soil, that its winters and springs are robbed of that predisposition to disease which they exert so effectually in other parts of the United States. But it is a matter of no great difficulty to detect the *sources* of our summer and fall diseases, and explain their operation, if we extend our view beyond the limits of the city. In the detail of the facts and observations, which occurred to us in this exterior view of the environs of the city, we shall exchange their techinical garb for the dress of plainness and simplicity.

In the earliest ages, the atmosphere was supposed to have great influence upon the human body in producing disease, as well as in restoring health. Hippocrates, the progenitor of our profession as a scientific art, remarked it; and Sydenham, Huxham, Rush, and many others, repeat the precept, "that physicians ought always to notice the state of the atmosphere during the prevalence of epidemic diseases." The last half century has produced innumerable and splendid arguments and demonstrations to uphold and magnify the importance of this opinion of the most eminent physicians, both ancient and modern. Before facts were collected, and experiments well performed, the ambient æther of this globe, the fluid æriform in which we exist, was supposed to be one simple homogenlous mass, and ranked as an element or indivisible substance. Within the period above stated, the atmospherical investigations of Priestly, Scheele, Cavendish and Lavoisier, repeated and multiplied by a number of their cotemporaries and successors, have

resulted in discoveries the most brilliant and interesting. Instead of an elementary fluid, as the ancients had supposed it, they have demonstrated the atmosphere to consist of a variety of elements, and have so far succeeded in the analysis as to separate them from each other, and detect and exhibit their properties distinctly. This fluid mass, diffused every where, the breath of life, deserves so much more the attention and investigation of physicians, as it is the only substance, without which we can scarce subsist alive a single moment; and whose good or bad qualities, have the greatest influence upon our constitutions. The most active poisons, which are known, do not so quickly destroy the life of an animal as the want of air, or the breathing of it when it is rendered highly noxious.

Since, then, we are now fully persuaded, that to *live* and to *breathe* are synonimous terms, and that the absolute necessity of air to the maintenance of animal life has been fully established, our surprise will cease on finding the most eminent philosophers of the last and of the present age, anxiously engaged in an examination of the chemical qualities of the atmosphere. The investigations of Priestly, of Lavoisier, of Cavendish, of Fontana, and many others, whose experiments on this subject are incontestible, have supplied us with the demonstration, that our atmosphere is a mixed and heterogeneous fluid, differing in different climates and situations in the proportions of the gases that compose it, and varying in point of purity form of variety of cir-

cumstances; such as the latitude of a place, the vicinity of large collections of water, the elevation and topography of a country, and, perhaps, more than all, from the seasons of the years. And, doubtless, many impure and hurtful airs emanate from the sources hereafter to be mentioned, are commixed and float in the atmosphere, of which the tests of the chemists have hitherto been unable to take any cognizance. Yet these tests have already led us many steps, and are still conducting the chemical philosopher towards the discovery of the *specific nature* of that *impurity*, which is evolved by the putrescent fermentation of *dead* animal and vegetable matters, the circulation and diffusion of which, by the operation of the winds, explain the reason of the *epidemic* insalubrity of the autumnal season.

That flat and marshy situations are unfavorable to health under certain circumstances, has been attested by physicians and historians of every age, in every country. The experiments of Franklin, Ingenhouzt, Vanbreda, White, and those of our very accurate and ingenious countryman, doctor Seybert, all unite in proving the contaminating influence upon the atmosphere, of marshes, low-grounds, and islands, with stagnant water exposed to the influence of the sun, both by obstructing and consuming a portion of its pure air, and by adding in return airs highly noxious and pestilential. Doctor Franklin and Mr. Ingenhouzt, long ago, detected the presence of one species of impure air (the inflammable) in the atmosphere of marshes. Vanbreda, experi-

menting upon the air of marshes in the *autumnal season*, found the proportions of the pure and impure gases considerably different from what obtain in healthy situations. In places favorable to health, the proportion of pure (vital) air is equal to twenty-seven parts in the hundred. In the sickly atmosphere of marshes, he discovered the prodigious deficit of from twelve to thirteen hundredths of pure air; beside this great diminution of vital air, he detected in the marsh atmosphere, a large proportion of noxious and mephetical gases.

Doctor Currie, reasoning from the facts furnished him by these experiments of Vanbreda, comes to this conclusion "That the causes of the unwholesomeness of low and moist situations, in the summer and autumnal months, are not owing to any invisible miasmata, or noxious effluvia, which issue from their soil, and lurk in the air, but to a very different cause; viz. to a deficiency of the oxygenous portion (pure air) of the atmosphere in such situations, in consequence of vegetable and animal putrefaction, in conjunction with the exhausting and debilitating heat of the days, and the sedative power of the cold and damp air of the nights." Though we cannot subscribe to the correctness of doctor Currie's theory, certainly not warranted by the result of the experiments of Vanbreda, yet we willingly coincide with him in attributing much to the deleterious effects of the "sedative power of the *cold* and *damp* air of the nights" in the vicinity of marshes, acting as it does in the capacity of a *predisposing* and *exciting* cause of disease.

What says the American chemist concerning the atmosphere of marshes? "Air collected," says doctor Seybert, "by agitating the stagnant water of marshes, contains two kinds of noxious air, but no pure air. Air obtained several feet above the surface of the marsh, contains some pure air, but in a very diminished quantity. The mud of marshes exposed to the action of atmospheric air, by means of a glass jar in a bason containing a small quantity of water, was found to produce the following changes, viz. The air contained in the jar became much diminished in bulk, as was proved by the water rising in the jar. The air, thus acted upon, when agitated with lime water, afforded a copious white precipitate, and became diminished in bulk;" in this manner discovering the presence of an elastic fluid, deleterious and unfit for animal respiration. Other tests, in the same course of experiments, confirmed and verified the uniform production of this species of noxious air from the mud of marshes. "The air, thus altered by the mud," continues doctor Seybert, "when mixed with the nitrous test, was in every instance found to have lost, in point of purity." So forcible, indeed, is the action of the mud of marshes upon atmospheric air, that, in one of the experiments, from which this extract is taken, "a large, strong bottle, closed with a ground stopper, was broken on the twenty-fifth day of the experiment, by an expansion of the contained elastic fluid; the pieces, which were large, were thrown to the distance of twenty feet, and a report was heard louder than that from the

firing of a musket." "The following circumstances seemed to have influenced the experiments—first, temperature; second, the length of time during which they were continued; and third, the proportion which the mud and air bore to each other; the surface of the mud being more or less extensive, seemed also to have its effects."

The above experiments teach us, that mud vitiates the atmosphere in a very powerful manner. They also enable us to account for the presence of many of the elastic fluids, that are found to exist in the atmosphere over marshes. The pure (*vital*) part of the common air, under the combined effects of heat and moisture, is attracted by the *dead* animal and vegetable matters that with an earthy basis form their mud. Its salutiferous properties hence are neutralized and changed, and the marsh makes a retribution for this spoliation upon the atmosphere, in gases poisonous and destructive to animal life. This is a truth, which hypothesis and gratuitous assertion cannot invalidate, since its basis is experiment.

That the atmosphere of marshes differs in certain circumstances from that of other situations, and that their soil has the effect of producing its altered and infected condition, can be further illustrated. The *putrefaction* of the *dead* animal and vegetable portion of it is the fountain of that contamination, which experience invariably feels, and chemistry has detected; for every species of soil will not operate in this manner. That the polluting cause arises from the *putrefaction*

of these matters, and that this state is absolutely necessary to the vitiation of their atmosphere, is inferred from the following circumstances, viz. Marshes have no noxious influence during the winter season in the temperate latitudes, the degree of heat being then below the putrescent point. They cause disease when the circumstances are present which promote putrefaction, as, a proper degree of heat, a due quantity of moisture, and the contact of atmospherical air, or the presence of substances capable of affording the base of pure air (oxygen) as water. That a degree of moisture is necessary appears evident from White's experiments. He says, " a certain degree of moisture seems necessary to produce the bad effects of marshes; for mud, when perfectly dry, did not alter the air." He might have added, that too much fluidity also prevents their morbid influence, as is proved by neighborhoods being healthy when they are overflowed. The inundation interposes and arrests the action of the sun upon the mud below. But White's experiments are still more explicit and demonstrative of the justness of the above remarks. " 1st, Air, confined during sixteen hours in a phial over water, did not suffer a change; 2d, pure clay, moistened, did not alter the purity of the air; 3d, sand, moistened, did not change the purity of the air; but, 4th, mud, which consists, (as we have stated) " of earths intimately mixed with *dead* animal and vegetable substances, always rendered the air very impure."

Hence, all the experiments that have been

made with the view of ascertaining and identifying the *specific cause* of the diseases to which marshes give birth, and all the reasoning which these experiments have given rise to, look to the putrefactive fermentation as its source. For, if there be removed only one of the three circumstances, viz. heat, moisture, and the contact of the base of pure air, which nature has selected as her agents to carry on that process (putrefaction) by which she changes the forms and qualities of matter, making new and very different compounds from a dissolution of the old, the incumbent atmosphere of the marsh will cease to be contaminated. But swamps and low moist grounds, that have been *cleared* and not *cultivated*, or of which the mode of culture permits, or requires the stagnation of water, present to the autumnal sun a suitable combination of these circumstances, in an abundant degree. For they, in this state, consist of more or less moisture, and of different proportions of dead animal and vegetable substances, blended with the original soil. Animals and vegetables, when they have suffered death, are subject to the laws which govern inanimate matters in general, and they are liable to the various changes produced by chemical mixture, and the laws of chemical affinity. They are acted upon by the powerful agents of nature, and thus suffer decomposition and form new combinations. The noxious and pestilent miasms, which infect their neighborhood, are of the number of these new combinations. Moreover, it is the opinion of the American Sydenham, doctor Rush, that the mi-

asmata which are the product of the putrefaction of a *mixed mass* of dead animal and vegetable substances, similar to what obtains in the mud of marshes, are more deleterious than those that issue from the separate decay of such matters.

Thus, we find, that the physical condition of marshes and moist low-grounds, under certain aircumstances, unites many causes to produce very considerable alterations in the state of the air, whereby it is rendered less fit for the respiration of animals, and becomes saturated with the seeds of disease ; and, if there were no means of restoring their primitive salubrity, they would instantly remain the manufactories of injury and fatality to the human race. Before we proceed to enumerate the means, and insist upon their application to the environs of Savannah, by which its bad air may be ameliorated and its circulation obstructed, we will advert to another circumstance.

When you ascend the steeple of the Exchange, and view the agricultural condition of the borders of the city, two-thirds of the prospect present you with an exhibition of the *sources* of its autumnal insalubrity, (in vain sought for within its limits,) and your mind is satisfied with the solution here offered of the questions—what has changed the original purity of its atmosphere ? and what continues to increase its unhealthiness ? The moist flats, and stagnant pools and ditches of Springfield and Valeroyal, and the rice fields on the southern bank of the Savannah river, present themselves on the west and south-west ; Hutch-

inson's island, under the culture of rice, on the north-west, north, and north-east; while the south-eastern view takes in the marshy low-grounds about Five-Fathom, and the rice fields extending from Mr. Turnbull's to town Clothed with the investments of nature, these places were originally pure, and emitted the fragrant breeze of health; but the ill-directed labors of our planters, in altering the plan of nature and arranging their own without the consultation of reason, have converted them into laboratories of disease one third of the year. After their invasion of the bog and of the swamp, by felling the umbrageous and prophylatic canopy that concealed them, that fatal enemy of mankind, who had been starved out of Europe by the *draining* and *cultivation* of its soil, and who, in this country, had heretofore slumbered in the state of torpor and hybernation, the *pestilent* and *insidious Python*, received the warm, stimulating nutriment of the sun, and was soon resuscitated into life. Within this topographic amphitheatre *now* are multiplied and aggregated *all* the circumstances we have stated, as prone necessarily to obey the laws of the pestilential and putrefactive fermentation, when subjected to the government and action of the summer heats. Here is water stagnant and at rest, moistening to the fermentative point the soil, abundantly supplied with the decaying exuviæ of animals and vegetables. June and July apply the Pythian match to this putrid mass. The inflammation enlarges as the year progresses, till the colds and frosts of November contract and extinguish it.

Nursed to maturity *in this cradle* by a depuration of the incumbent atmosphere, this fabled monster of ancient Greece, about the first of August, unfurls to the winds his morbific banners. From the middle of July to the middle of August, he is dressed in the livery of the mild remittent, or ague and fever; through September he is clad in the armor of the more fatal bilious remittent; and lastly, in October, he frequently assumes the lethiferous weapons of the deadly yellow fever.

The wind has been justly called "Nature's best scavenger." It purges the contaminating sources we have mentioned, indeed, of much of their infection; but it deposits much of it with us. In morals it is an adage, that bad company corrupts good habitude of mind. The truth and force of this maxim hold good here in physics. The winds that prevail here in the summer and fall, veer from the east and south-east, to the north and west, presenting us, on their visits in the autumn, with the peccant effluvia, of which they have despoiled the swamps, ditches, and rice-fields, in their passage over them. Much more acceptable, at this season, would be the arid and oppressive currents of the south.

That the air receives different impregnations from the nature and qualities of the soil over which it passes, is acknowledged and felt in every part of the world. The Neapolitan is alarmed and depressed, whenever the wind points from the south-east—the northern African dreads the southern blast. If then the sirocco is so alarming, from the sedative and lethargising influence it

imbibes in passing over the volcanic deserts of Vesuvius; if the Kamsin and Harmattan, in blowing over an extensive surface of sand, "fountainless and dry," strike the African prostrate with fear and suffocation, what ought to be our apprehensions from the ærial currents above stated, when, in their course over these laboratories of infection to this city, Hutchinson's island and the rice-fields to the eastward and westward, they deluge us with a polluted atmosphere?

The question now occurs, can this morbid operation of these *present* sources of disease to our city be obviated? It can; and we now appeal to the lessons of experience, the maxims of reason, and to the labors of art to accomplish it.

In treating of this last, but most important devision of our subject, we should, in the first place, notice the barrier which nature still presents partially for our protection. In this she holds out to art a prominent example. The elevated situation of the bluff, in some parts of it annually augmenting by the action of the winds, serves in some degree as a northern and northeastern shield to the city, by mechanically obstructing the access of some of the bad airs elaborated upon the opposite islands. The more ponderous of these unwholesome gases can scarcely be supposed to float so high in the atmosphere as twenty and thirty feet, unless propelled by the force and obliquity of the current. They are impelled by the winds against the bluff and the buildings under it, whence they recoil upon the river and are absorbed, or they range its sides eastward and westward to the extremities of the city.

We shall now suggest a plan, which reason and experience prompt, and industry certainly can effect, of diminishing and repressing the number and violence of our fevers, and of rendering our city again healthy. This is, 1st. the planting of as many trees around the town, and in the streets, lanes and squares, as circumstances will admit. They should be placed on the northern and eastern, as well as on the southern and western, exposure of the streets and squares of the whole city. Let the trees be planted in the greatest number and closest together, behind Carpenter's Row, west of Yamacraw, and in front of the Bay. The tree we have already adopted, the pride of India, is quick in its growth, agrees remarkable well with our soil and climate, and spreads both to the sun and to the winds a shield of ramification, thick and diffusive; consequently it is well suited to the purposes here contemplated. Thus arranged, their salutary operation would be threefold. 1. They cool the whole city, by shading its streets and preventing the heat evolved by the direct incidence of the solar ray, and by reflection from their silecious soil. Thus is, and might much more be diminished, one of the great *exciting* causes of our diseases, i. e. the superabundant heat of the atmosphere. 2. They would have a mechanical effect in resisting the circulation of the impure airs from without. It is, perhaps, much owing to this mode of their operation, that the bay has been so much benefited by that colony of trees in front of it. "I have known," says doctor Rush, "several instances of families

being preserved from fevers by an accidental copse of wood standing between a mill-pond and a dwelling house, and that in cases too where the house derived no advantage from an *high situation.*" That mechanical opposition has considerable effect in repressing the circulation of a contaminated current of air would seem to us to be proved, by the center of the city being the healthiest, while its *borders* are the *center* of disease. 3. But they act chemically also. They absorb the impure airs wafted over upon them, decompose them, and emit pure air, thus countervailing in some degree the polluting effect of the adjacent rice-fields. In this operation the willow tree, which rejoices equally in our climate, might be advantageously interspersed with the pride of India; for, according to Mr. Ingenhouzt, it was found to purify air the most rapidly of any tree that he subjected to his experiments. The rapidity of its growth, its early verdure, and the late fall of its leaf, all seem to mark it likewise as a tree highly proper for the attention and nurture of the inhabitants of this city.

2d. The next object to be attended to, in order to render our city more healthy, is a *change* in the *kind* of cultivation of the islands and low-ground in its neighborhood; for it is *this present form* of their agriculture that has changed them into a *Pandora-box* to Savannah. Without them, or with them under a different mode of cultivation, could there be any reason why we should not be as healthy as the inhabitants of St. Augustine, St. Mary's, and of many other places whose cli-

mates are as warm? Their polluting operation may be prevented in three ways. One is, to keep them in a state of complete inundation during the hot months. We have already shewn that moisture, to aid in producing the degree of atmospheric pollution under consideration, must be of a certain small quantity. The history of epidemics in foreign countries, favors this opinion. The inhabitants of Egypt are always healthy during the overflowing of the Nile. Their fevers appear only after the recess of the river. A second method of obviating their production of bad and infectious air, is, to remove their *redundant* moisture. This may be effected by dyking out the water and covering their mud with sand, clay, and other substances not liable to putrefaction. But, as each of these modes of purification would be both expensive and unprofitable, we will with much pleasure enter upon the consideration of the third, which embraces health, ornament, utility and comfort. In the adoption of this plan, the inhabitants of Savannah will congratulate themselves on the state of its atmosphere ameliorated, and with a return of its original salubrity. It consists in wholly abandoning the cultivation of rice in its vicinity, and substituting that of the grasses and such other vegetables as do not require the rest and stagnation of superfluous moisture. Let every spot covered with water in this condition, from which the wood has been cut, be carefully drained, and afterwards sowed with grass seed; let weeds of all kinds be destroyed, and let the waters be so directed as to

prevent their stagnating in any part of their course. In addition to the grasses, the vine, the Indian corn, the orange, the fig, and many other vegetables might be reared upon these islands and flats, with infinite profit and advantage. Horticulture, in all its variety and profusion, would thrive with luxury in such a soil. On the surrounding and intersecting banks, that should necessarily be thrown up to dyke out the water, plant and intersperse the pride of India, the willow, the live oak, the apple and the peach tree. In this, nature seems to have connected together our duty, interest and health. Instead of generating bad air, as the culture of rice indubitably does, these would derive nutriment from the impurities that might still exist; and, after analysing them and retaining a part of the purposes of their economy, would replenish the atmosphere with the pure pabulum of life. For it is well known that plants thrive better in foul than in pure air, and that they have a power of correcting bad air. The discoveries of Priestly and of Ingenhouzt throw a new and important light upon the arrangement of this globe. They shew, even to demonstration, that the vegetable kingdom is subservient to the animal, in more ways than one; and that the air, which is spoiled and rendered noxious to animals, serves to plants as a kind of nourishment. The grasses and all plants of vigorous growth have been found, by real experiment, highly to improve the condition of the atmosphere, especially when surrounded by air that has been fouled by putrefaction and the res-

piration of animals. Vegetables, when living and growing, and exposed to the rays of the light, constantly decompose the water they imbibe from the earth, and the impure airs they absorb from the atmosphere, dissolving the affinity by which the mud had attracted and inchained the base of pure air, and committing it to the wings of heat and light, again to be diffused in the atmosphere, while they retain the elements, with which it had been combined, for the formation of their oil, wax, honey, resin, &c.

"We are assured from undoubted experiments," says sir John Pringle, "that no vegetable grows in vain; but that from the oak of the forest to the grass in the field, every individual plant is serviceable to mankind. If not always distinguished by some private virtue, yet making a part of the whole, which cleanses and purifies our atmosphere. In this respect, the fragrant rose and the deadly nightshade co-operate; nor is the herbage, nor the woods, that flourish in the most remote and unpeopled regions unprofitable to us, nor we to them; considering how constantly the winds convey to them our vitiated air, for our relief and for their nourishment. And, if ever these salutary gales rise to storms and hurricanes, let us still trace and revere the ways of a beneficent Being, who, not fortuitously, but with design—not in wrath, but in mercy—thus shakes the waters and the air together, to bury in the deep those fluid and pestilential effluvia, which the vegetables upon the face of the earth had been insufficient to consume." With what *admirable*

economy then has the *Supreme Architect* established this *reciprocal intercourse* between the *animal* and *vegetable* kingdoms! By what elegant simplicity of design are the different parts of nature thus rendered at once subservient to the mutual support of each other respectively, and to the general well-being and harmony of the whole.

But these, as great and important as they would be, are not all the advantages that necessarily must be the offspring of an adoption of the measures we have proposed. Independently of the luxury of a pure and untainted atmosphere, our health, to which this is so essential, would receive another substantial guarantee in the amelioration of our markets. An inexhaustible and prolific source would thus be opened for the cultivation of esculent vegetables, of the best quality and of abundant variety; whence, without the aid of importation from abroad, we should cheaply supply our tables in profusion, with provisions of every description, in the best state. Then, with wholesome food and pure air, and protected by the shade of our industry, we should the more feel it our duty to bow the knee of adoration and homage to the *Author of all good*, who, in blessing us with a most excellent winter and spring climate, has endowed us with the faculties of reason, and the powers of art, to obviate the inclemencies of our autumn.